

REMARKS

This paper is responsive to the Office Action dated August 14, 2009. Presently, claims 46-72 stand rejected. For the following reasons, reconsideration is respectfully requested.

Applicants have amended the specification in order to incorporate the priority and benefit information as set forth in the declaration.

Section 103(a) Rejections:

Claims 46, 48-57, and 71.

Claims 46, 48-57, and 71 were rejected under 35 U.S.C. § 103(a) as being unpatentable over O'REAR et al (WO 01/64610 A1).

Generally speaking, the present invention relates to the use of a hydrocarbon condensate containing olefins, paraffins and oxygenates from a low temperature Fischer-Tropsch reaction in the production of linear alkyl benzene. The condensate "condensation product" is described at page 8 of the present application, and contains olefins and paraffins in the C4 to C26 range, and oxygenates including alcohols, esters, aldehydes, ketones and acids.

As explained at page 8 paragraph 3, of the application, olefins only make up approximately 10 to 30% by weight of this product. The product would not normally be considered useful in an alkylation reaction to form linear alkyl benzene, because of the need to remove oxygenates. Nevertheless, the inventors have surprisingly found a way to use this condensate product to produce linear alkyl benzene in an economically viable way. An advantage of the condensate product is that the olefins have a very high degree of linearity of greater than 95% which leads to the production of highly linear alkyl benzene.

At point 8 of the Office Action, the Examiner asserts that O'REAR discloses a process for producing linear alkyl benzene, the process including the step of obtaining a hydrocarbon condensate containing olefins, paraffins and oxygenates from a low temperature Fischer-Tropsch (F-T) reaction and subsequently using this hydrocarbon condensate in a process for producing linear alkyl benzene. Applicants

respectfully dispute this characterization of O'REAR. Applicants specifically dispute the contention that the condensate contains olefins. Furthermore, Applicants submit that O'REAR does not use the hydrocarbon condensate in an alkylation reaction with benzene to produce linear alkyl benzene.

The C18-C26 fraction of F-T synthesis mentioned at page 2, line 13 and page 30, line 14 of O'REAR as being suitable for use in the production of linear alkyl benzene is described at page 14, lines 7-15. Applicants dispute the Examiner's characterization of the fraction described in O'REAR at page 14 lines 7-15 as a "condensate fraction" from a F-T reaction. It is clear that this fraction, which contains catalyst fines (see page 14 line 9), is not a condensate. A condensate from a F-T reaction does not contain fines.

The F-T condensate fraction described in O'REAR at page 14 lines 1-5, which is said to include C5 to C20 normal paraffins and higher boiling hydrocarbons, is used in O'REAR to provide a C6-C8 fraction which is used to form aromatics. The condensate is not alkylated with benzene to form linear alkyl benzene. Furthermore, there is no mention in O'REAR that this fraction even contains olefins. It is clear that O'REAR did not consider the condensate fraction from a F-T reaction suitable for use in a process for producing linear alkyl benzene.

O'REAR does not describe or suggest the use of a condensate product as claimed in claim 46. There is therefore no reason for a person of ordinary skill in the art to modify O'REAR to produce the condensate product defined in Claims 48-57 of the present application.

Applicants point out that in a previous response, it was argued that a key portion of the invention is that the inventors have found that it is possible to take the hydrocarbon condensate of a Fischer-Tropsch reaction containing olefins and paraffins, remove oxygenates from the condensate, and provide a stream which is the product of a Fischer-Tropsch reaction and which contains paraffins and sufficient olefins to be able to pass the stream through an alkylation reactor and obtain a linear alkyl benzene product as well as a linear paraffin product, without first having to dehydrogenate the feedstream.

Although O'REAR does state at page 2, lines 14-16 that the fractions are optionally but preferably treated, for example, by hydrotreating or extraction, to remove oxygenates and other by-products, in the detailed description at page 12, lines 3-4 of O'REAR, it is stated that the Fischer-Tropsch stream is preferably hydrotreated to remove any oxygenated products. At page 4, lines 19-20 of the detailed description of the invention and in Figure 1 of O'REAR, it is stated and shown that a C18-C26 fraction from a Fischer-Tropsch reaction is dehydrogenated to form C18-26 olefins, which are used to alkylate aromatics. Thereafter at page 30, lines 14-15 it is stated that the paraffinic C18-C26 fraction must be converted into olefins, for example, via dehydrogenation chemistry. It is clear that, although O'REAR mentions extraction to remove oxygenates, the preferred method of oxygenate removal is hydrotreatment.

Furthermore, irrespective of the type of oxygenate removal step, O'REAR et al teaches that the fraction must be dehydrogenated prior to the alkylation step. As previously stated, the olefins subjected to the alkylation reaction in O'REAR et al are the product of a dehydrogenation reaction, and not the product of a Fischer Tropsch reaction. The Examiner addressed this argument at point 29 of the Office Action where he states that the dehydrogenation reaction taught by O'REAR only converts a portion of the paraffins and olefins in order to prepare the alkylbenzenes and that "..... olefins and remaining paraffins are from an F-T reaction despite the assertion of the applicant to the contrary". In the previous response, Applicants intended to emphasize that the reference, in Claim 46, to "a stream containing olefins and paraffins which is the product of a Fischer-Tropsch reaction" is to the entire stream, and not to components of the stream. Once a hydrocarbon stream which is the product of a Fischer-Tropsch reaction undergoes a dehydrogenation reaction it is no longer a product of a Fischer-Tropsch reaction, but rather, the stream is a product of a dehydrogenation reaction.

In the invention claimed in Claim 46, the condensate stream used in the alkylation step d) is the product of a Fischer-Tropsch reaction which has not undergone an expensive dehydrogenation step.

At page 2 lines 25-27 in the summary of the invention, O'REAR states that depending on the particular Fischer-Tropsch conditions, the C18-C26 fraction may include

sufficient olefins and alcohols such that it can be directly reacted with aromatics to form alcohol benzenes. In this case, where O'REAR suggests the direct reaction of the C18-C26 fraction in an alkylation reaction without a dehydrogenation step, no oxygenate removal step is suggested. If an oxygenate removal step did take place, the fraction would not "include sufficient olefins and alcohols", because the alcohols would have been removed. Accordingly, where a direct alkylation step is suggested in O'REAR, no oxygenate removal step is suggested. Applicants submit that this reference actually teaches away from the present invention because it indicates that the O'REAR inventors did not believe that it would be possible to remove oxygenates from the stream and still have sufficient olefins for an alkylation reaction to form alkyl benzene.

At point 9 of the Office Action, the Examiner concedes that while O'REAR discloses the dehydrogenation reaction of the paraffins in the feedstock (with recycle of unreacted paraffins from the downstream alkylation thereto) prior to the alkylation reaction, O'REAR does not disclose the sequence claimed in Claim 46 of this application, i.e. the alkylation reaction (step d) prior to the dehydrogenation reaction (step g). The Examiner is however of the view that this difference is *prima facie* obvious in the absence of new and unexpected results. Applicants respectfully disagree.

The dehydrogenation step g) after the alkylation step d) claimed in Claim 46 and subsequent recycle step h) from step g) to step c) is not a mere obvious selection of steps. The stream from step b) which is the product of a Fischer-Tropsch reaction and which contains paraffins and olefins (e.g., 10 to 30% by weight – see page 4 line 25 and Claim 72) is combined in step c) with the stream from step g) which contains, e.g., 10 – 15 % by weight olefins (see page 4 line 26 and Claims 71 and 72) so that the stream in step c) has a reduced olefin content of, e.g., 12.5% to 22.5% by weight (see page 4 line 27 and Claim 72). The reduction of the olefin content of the stream from step b) by mixing it, in step c), with the stream from step g) is counter-intuitive. However, it has the advantage of increasing the olefin concentration in the recycle from the dehydrogenation process (i.e. the stream from step g). With reference to the passage from page 14, line 28 to page 15, line 12, the increase in olefin concentration in the recycle stream from the dehydrogenation step g) results in a reduction in the recycle

flow rate of a dehydrogenation process for a fixed production of linear alkyl benzene (see page 14, lines 28-31).

From a capital expenditure point of view the reduced recycle rate flow rate allows for a reduction in size of the dehydration reactor as well as a reduction in size of the alkylation reactor for a fixed residence time, and the reduced paraffin flow rate allows for a reduction in the size of the paraffin-recovery column and ancillary equipment (see page 15, lines 2-7). Operation expenditure savings include a reduced mass flow rate through the dehydrogenation reactor, and also results in a reduction in the hydrogen flow rate required for selective hydrogenation of dienes. A reduction in the paraffin flow rate will allow for savings in utilities such as cooling water, steam (or hot oil) and electricity (see page 15, lines 7-12).

From the above, it is evident that O'REAR does not describe or suggest the process for producing linear alkyl benzene from a hydrocarbon condensate from a low temperature Fischer-Tropsch reaction defined in Claims 46, 48-57 and 71.

In particular, O'REAR does not describe or suggest at least the following:

- a) the use of a fractionated hydrocarbon condensate stream containing olefins paraffins and oxygenates from a low temperature Fischer-Tropsch reaction in the production of linear alkyl benzene;
- b) extracting oxygenates from the condensate stream and using the stream in an alkylation reaction without an intervening dehydrogenation step;
- c) a dehydrogenation step following the alkylation step, the dehydrogenation step being run at a low conversion rate to provide a stream having a low olefin concentration (e.g., 10-15% by weight) and recycling and mixing this stream with the hydrocarbon condensate prior to alkylation.

Furthermore, O'REAR does not suggest the benefits that are obtained in the process of the present invention by using a hydrocarbon condensate from a F-T reaction in an alkylation reaction without an intervening dehydrogenation step as well as the benefits of the counter-intuitive recycle of the stream having a low olefin concentration (10-15% by weight) from the dehydrogenation step.

Claims 47, 58-70, and 72:

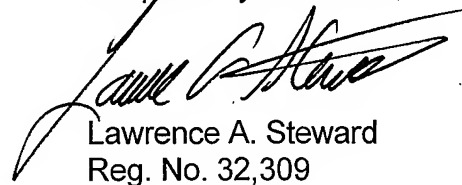
Claims 47, 58-70 and 72 were rejected under 35 U.S.C. § 103(a) as being unpatentable over O'Rear as applied to claims 46, 48-57, and 71 above, and in further view of Becker (DE 1991910 A1) and De Wet et al (WO 02/31085 A2).

Each of claims 47, 58-70, and 72 depends, directly or indirectly, from independent claim 46, and therefore includes all of its limitations. Therefore, these claims are believed to be nonobvious over the cited references for at least the same reasons that claim 46 is nonobvious.

Conclusion:

Based upon the foregoing, Applicants respectfully submit that the present invention, as claimed herein, is novel and inventive in view of the prior art cited by the Examiner. Accordingly, Applicants respectfully request the issuance of a Notice of Allowance. If the Examiner believes the prosecution of this application can be advanced by way of a telephone conversation, the Examiner is respectfully invited to telephone the undersigned attorney.

Respectfully submitted,



Lawrence A. Steward
Reg. No. 32,309

BRINKS HOFER GILSON & LIONE
CUSTOMER NO. 27879
Telephone: (317) 636-0886
Fax: (317) 634-6701